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10/086,117	02/26/2002	Christo P. Bojkov	TI-33887	2251

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EXAMINER
LEWIS, MONICA

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 05/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/086,117	Applicant(s) BOJKOV ET AL.	
	Examiner Monica Lewis	Art Unit 2822	

-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 June 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) *13-18* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *14 June 2002* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

1. This office action is in response to the application filed February 26, 2002.

Election/Restrictions

2. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-12, drawn to a metal structure for a contact pad, classified in class 257, subclass 738.

II. Claims 13-18, drawn to the method for cleaning the surface of copper metallization, classified in class 438, subclass 584.

Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). It can be made utilizing sputtering or CVD.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Michael Skrehot on May 1, 2003 a provisional election was made without traverse to prosecute the invention of a structure for a contact pad, claims 1-12. Affirmation of this election must be made by applicant in replying to this Office action. Claims 13-18 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Drawings

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: a) 106 (See Page 2 Line 12); b) 614a and 615a (See Page 16 Lines 14 and 20); and c) 618 (See Page 17 Line 3).

Information Disclosure Statement

4. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-3, 9, 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (U.S. Publication No. 2002/0096764).

In regards to claim 1, Huang discloses the following:

a) a portion of said copper metallization exposed by a window in said overcoat (For Example: See Figure 7);

b) a patterned copper layer (340b) directly positioned on said clean copper metallization, whereby said metal structure has an electrical conductivity about equal to the conductivity of pure copper, said layer overlapping the perimeter of said overcoat window (For Example: See Figure 7); and

c) a copper stud (340d) positioned on said copper layer, following the contours of said copper layer (For Example: See Figure 7).

In regards to claim 1, Huang fails to disclose the following:

a) exposed copper having a clean surface.

However, the limitation of "exposed copper having a clean surface" makes it a product by process claim. The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A *"product by process"* claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972): *In re Luck and Gainer*, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a *"product by, all of"* claim, and not the patentability of the process, and that an old or obvious product, whether claimed in *"product by process"* claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

In regards to claim 2, Huang discloses the following:

a) copper surface is free of copper oxide, organic residues, and contamination (For Example: See Figure 7).

In regards to claim 2, Huang fails to disclose the following:

a) clean copper surface.

However, the limitation of "clean copper surface" makes it a product by process claim. The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A *"product by process"* claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972): *In re Luck and Gainer*, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a *"product by, all of"* claim, and not the patentability of the process, and that an old or obvious product, whether claimed in *"product by process"* claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

In regards to claim 3, Huang discloses the following:

a) direct positioning of said copper layer on said copper pad provides the lowest possible electrical resistance and relinquishes the need for an intermediate barrier or under-bump layer (For Example: See Figure 7).

In regards to claim 3, Huang fails to disclose the following:

a) clean copper pad.

However, the limitation of "clean copper pad" makes it a product by process claim. The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A *"product by process"* claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972): *In re Luck and Gainer*, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a *"product by, all of"* claim, and not the patentability of the process, and that an old or obvious product, whether claimed in *"product by process"* claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

In regards to claim 9, Huang discloses the following:

a) copper layer follows the contour of said perimeter of said overcoat window (For Example: See Figure 7).

In regards to claim 11, Huang discloses the following:

a) a portion of said copper metallization exposed by a window in said overcoat (For Example: See Figure 7);

b) a patterned copper layer directly positioned on said clean copper metallization, whereby said metal structure has an electrical conductivity about equal to the conductivity of pure copper, said layer overlapping the perimeter of said overcoat window (For Example: See Figure 7); and

c) a copper stud positioned on said copper layer, and one of said solder bumps bonded to said copper area (For Example: See Figure 7).

In regards to claim 11, Huang fails to disclose the following:

a) exposed copper having a clean surface.

However, the limitation of "exposed copper having a clean surface" makes it a product by process claim. The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A *"product by process"* claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972): *In re Luck and Gainer*, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a *"product by, all of"* claim, and not the patentability of the process, and that an old or obvious product, whether claimed in *"product by process"* claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

In regards to claim 12, Huang discloses the following:

a) solder bumps are selected from ,a group consisting of tin, indium, tin/lead, tin/indium, tin/silver, tin/bismuth, conductive adhesives, and z-axis conductive materials (For Example: See Paragraph 23).

7. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (U.S. Publication No. 2002/0096764) in view of Hur et al. (U.S. Patent No. 6,476,494).

In regards to claim 4, Huang fails to disclose the following:

a) copper layer has a thickness in the range from about .3 to .8 *u*m.

However, Hur et al. ("Hur") discloses the use of a copper layer that ranges from about .3 to .8 *u*m (For Example: Column 6 Lines 62 and 63). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Huang to include the use of a copper layer that has a thickness that ranges from about .3 to .8 *u*m as disclosed in Hur because it aids in providing a high density device (For Example: See Column 1 Lines 13-37).

Additionally, since Huang and Hur are both from the same field of endeavor, the purpose disclosed by Hur would have been recognized in the pertinent art of Huang.

Finally, the applicant has not established the critical nature of the dimension of a copper layer that "has a thickness in the range from about .3 to .8 *u*m" "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

8. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (U.S. Publication No. 2002/0096764) in view of Edelstein et al. (U.S. Patent No. 6,133,136).

In regards to claim 5, Huang discloses the following:

a) overcoat (330) is a moisture-impermeable inorganic layer including silicon nitride (For Example: See Figure 7).

In regards to claim 5, Huang fails to disclose the following:

a) overcoat including silicon nitride and silicon oxynitride of approximately 1.0 um thickness.

However, Edelstein et al. ("Edelstein") discloses the use of an overcoat including silicon nitride and silicon oxynitride of approximately 1.0 um thickness (For Example: See Column 2 Lines 40-47). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Huang to include the use of an overcoat including silicon nitride and silicon oxynitride of approximately 1.0 um thickness as disclosed in Edelstein because it aids in improving the structural integrity of the device (For Example: See Column 1 Lines 1-63).

Additionally, since Huang and Edelstein are both from the same field of endeavor, the purpose disclosed by Edelstein would have been recognized in the pertinent art of Huang.

Finally, the applicant has not established the critical nature of the dimension of "a overcoat including silicon nitride and silicon oxynitride of approximately 1.0 um thickness" "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range

achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

9. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (U.S. Publication No. 2002/0096764) in view of Edelstein et al. (U.S. Patent No. 6,133,136) and Applicant's Prior Art.

In regards to claim 6, Huang discloses the following:

a) inorganic layer forms a perimeter around said window coverable by said copper layer (For Example: See Figure 7).

In regards to claim 6, Huang fails to disclose the following:

a) window with a slope.

However, Applicant's Prior Art discloses the use of a window with a slope (For Example: See Figure 4). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Huang to include the use of a window with a slope as disclosed in Applicant's Prior Art because it aids in overcoming solder attachment problems (For Example: See Page 11 Lines 6-12).

Additionally, since Huang and Applicant's Prior Art are both from the same field of endeavor, the purpose disclosed by Applicant's Prior Art would have been recognized in the pertinent art of Huang.

10. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (U.S. Publication No. 2002/0096764) in view of Applicant's Prior Art and Gansauge et al. (U.S. Patent No. 5,010,389).

In regards to claim 7, Huang fails to disclose the following:

a) overcoat is a sequence of an inorganic layer adjacent to the integrated circuit, overlaid by a polymeric layer including polyimide, benzocylobutene, and polybenzoxazole.

However, Applicant's Prior Art discloses the use of a polymeric layer (For Example: See Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Huang to include the use of a polymeric layer as disclosed in Applicant's Prior Art because it aids in reducing stress (For Example: See Page 3 Lines 14-30).

Additionally, since Huang and Applicant's Prior Art are both from the same field of endeavor, the purpose disclosed by Applicant's Prior Art would have been recognized in the pertinent art of Huang.

b) polymeric layer of approximately 3.0 to 10 um thickness.

However, Gansauge et al. ("Gansauge") discloses the use of a polymeric layer that is approximately 3.0 to 10 um thick (For Example: See Column 5 Lines 18-20). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Huang to include the use of a polymeric layer that is approximately 3.0 to 10 um thick as disclosed in Gansauge because it aids in improving the packaging of the device (For Example: See Abstract).

Additionally, since Huang and Gansauge are both from the same field of endeavor, the purpose disclosed by Gansauge would have been recognized in the pertinent art of Huang.

Finally, the applicant has not established the critical nature of the dimension of "polymeric layer of approximately 3.0 to 10 um thickness" "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

In regards to claim 8, Huang discloses the following:

a) sequence of layers forms a perimeter around said window coverable by said copper layer (For Example: See Figure 7).

In regards to claim 8, Huang fails to disclose the following:

a) window with a slope.

However, Applicant's Prior Art discloses the use of a window with a slope (For Example: See Figure 4). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Huang to include the use of a window with a slope as disclosed in Applicant's Prior Art because it aids in overcoming solder attachment problems (For Example: See Page 11 Lines 6-12).

Additionally, since Huang and Applicant's Prior Art are both from the same field of endeavor, the purpose disclosed by Applicant's Prior Art would have been recognized in the pertinent art of Huang.

11. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (U.S. Publication No. 2002/0096764) in view of Kleffner et al. (U.S. Patent No. 5,943,597).

In regards to claim 10, Huang discloses the following:

a) copper stud has a thickness and a width equal to the extent of said copper layer, following the contour of said perimeter of said overcoat window (For Example: See Figure 7).

In regards to claim 10, Huang fails to disclose the following:

a) copper stud thickness of 10 to 20 um.

However, Kleffner et al. ("Kleffner") discloses the use of a copper stud that has a thickness of 10 to 20 um (For Example: See Column 3 Lines 14 and 15). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Huang to include the use of a copper stud that has a thickness of 10 to 20 um as disclosed in Kleffner because it aids in providing a structure that accommodates thermal and mechanical stress (For Example: See Column 1 Lines 5-9).

Additionally, since Huang and Kleffner are both from the same field of endeavor, the purpose disclosed by Kleffner would have been recognized in the pertinent art of Huang.

Finally, the applicant has not established the critical nature of the dimension of "a copper stud that has a thickness of 10 to 20 um" "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

Conclusion

12. The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure: a) Bhattacharya (U.S. Patent No. 4,514,751) discloses a passivated semiconductor device; b) Paik et al. (U.S. Patent No. 6,362,090) discloses a flip chip bump; and c) Ling et al. (U.S. Publication No. 2002/0096765) discloses a metallization structure.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 703-305-3743. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 703-308-4905. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722 for regular and after final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

ML
May 4, 2003

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